nected to a normally closed pushbutton switch) can clear a fault on U1 or supply a manual reset. An internal pull-up to V_{CC} eliminates the need for an external pull-up resistor. Replacing the pushbutton switch with an interlock or single-pole, single-throw (SPST) switch supplies a power-disconnect signal, which can implement a chassis-intrusion interlock or allow a technician to power-down the unit before swapping circuit cards. Because U2's push-pull output can't be directly OR-connected with other signals joined to U1's ON pin, Q2 is added to create an OR-able open-drain connection.

A temperature switch (U3) adds thermal protection, and its open-drain output can be linked either directly (wire-OR'd) to other signals on U1's ON pin, or separately, back to the microprocessor. With its TO220 package option, U3 can be bolted to a heatsink or surface-mounted (SOT23 option) close to known heat-generating sources such as R1, Q1, or the main load.

In this circuit, U3 provides circuit protection by issuing a power-disconnect signal when the circuit temperature becomes critical. A low-power linear regulator (U4) supplies 5 V to the low-voltage components U2 and U3, but U4 isn't meant to provide system power to the load. ***ED Online 5396***

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Increase Common-Mode Range For Fully Differential Amplifiers

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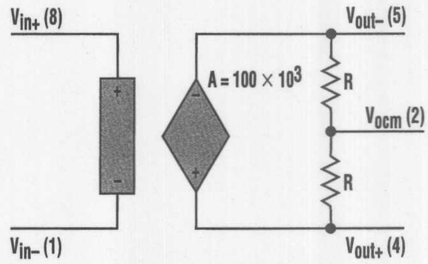
Fully differential amplifiers have grown in popularity because of their low distortion, excellent noise rejection, and the simplicity of interfacing them with differential analog-to-digital converters (ADCs). This application shows how to increase the common-mode range of a fully differential amplifier by using a few external resistors *(Fig. 1)*.

The circuit uses a voltage-divider technique to reduce the voltage at the inputs of the differential amplifier. This method was adapted from a technique employed on a monolithic instrumentation amplifier (INA148) for use with the fully differential amplifier. Implementing the given configuration, the amplifier's common-mode range is approximately ±90 V, with a differential gain of approximately 1.0. Even wider common-mode ranges could be achieved using a larger R1/R2 ratio.

Three important considerations when executing this topology are determining the gain, the maximum common-mode range, and the common-mode rejection. Modeling the differential amplifier as a voltage-controlled voltage source is the basis of the analysis *(Fig. 2)*.

Assuming the resistors are equivalent in both halves of the amplifier simplifies the analysis (i.e., R1a = R1b = R1). Equation 1 gives the gain of the amplifier.



2. For analysis purposes, the differential amplifier is modeled as a voltage-controlled voltage source.

$$V_{OUT} = (V_{IN1} - V_{IN2}) \times \frac{(R_4R_3 + R_3R_2 + R_4R_2)}{(R_1R_4)} \quad (1)$$

This simplified equation will always yield a zero common-mode output. Performing a more detailed analysis that uses unique values for all resistances produces a far more complex equation. ***ED Online 5395***

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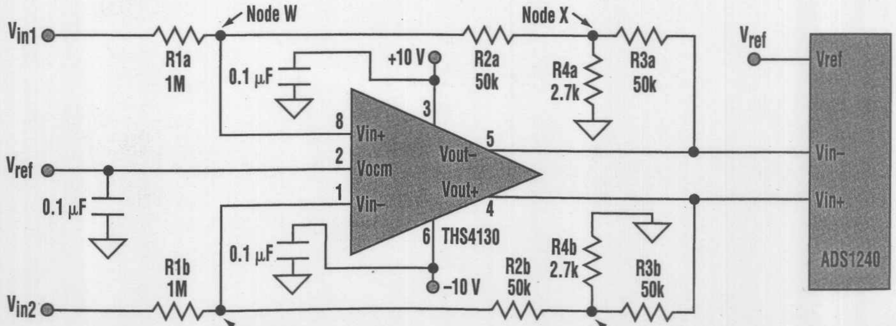

1. Resistors R1 and R2 form a voltage divider that increases this differential amplifier's common-mode range to approximately ±90 V.